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ABSTRACT

Many factors influence the comprehension of a linguistic act by a listener or reader. Some, such as maturity, background, and interests of the decoder are nonlinguistic: others, such as the vocabulary and complexity of the morphological and syntactical structures are linguistic in nature. A review of the literature reveals that while studies have been able to correlate readability formulas and T-units with comprehension difficulty, they have major theoretical shortcomings in that they concentrate almost exclusively on the surface structure of sentences. Deep structure research based on generative-transformational grammar generally reveals that as sentences deviate from kernels, they become more difficult to comprehend. However, no definitive hierarchy of linguistic complexity has been validated yet. Many studies have been hampered in that they were only concerned with assessing the relationship of linguistic complexity to literal comprehension and were using isolated sentences. Other studies created testing situations that were divorced from the normal listening and reading acts of daily life. As a result, it is not possible to synthesize the results of the various studies into a definitively sound, empirically verifiable whole. (Author/FL)

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Linguistic Complexity As a Factor in Comprehension Difficulty

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THE READING PROCESS

Decoding and Comprehension

The hoped for result of any linguistic act, be it oral or written, is the comprehension of the message by the listener or reader. At its most basic level, comprehension can be defined as the suitable decoding of the linguistic unit, be it a word, a phrase, a sentence, or a passage, so that the receiver apprehends both the message and the intentions of the sender or encoder. In other words, at its basis is the transmittal of some message which is linguistically coded from a sender to a receiver. Not only does the code have to be broken, but the information has to be understood.

Listening and reading comprehension are similar, but the latter imposes some additional tasks. A phoneme-grapheme code is employed, and sometimes the reader must also organize the decoded units into a meaningful structure. On the other hand, the pace of decoding is usually set by the decoder himself whereas the encoder sets the pace in a talking-listening activity. This can be beneficial to the reader for he can process the material slower or reread it a second or third time if it is especially difficult. However because of their essential similarity, I will discuss linguistic factors that influence comprehension in general, both in verbal and written formats.

Levels of Comprehension

Various writers have described different levels of reading comprehension. I will only deal with one such taxonomy here in order to define the limits of this present critical review. I will use Barrett's Taxonomy of Reading

Comprehension, which itself was adapted from Bloom's Taxonomy of Educational Objectives. In this study, he categorized reading comprehension into the following hierarchy:

1.) Literal Recognition or Recall (including the recall or recognition of details, main ideas, sequences, comparisons, cause and effect relationships, and character traits)

2.) Inference (including drawing inferences about supporting detail, main idea, sequence, comparison, cause and effect, character traits, outcomes, and figurative language)

3.) Evaluation (including drawing judgments about reality versus fantasy, fact versus opinion, adequacy or validity, appropriatness, and acceptability)

4.) Appreciation (including emotional reactions to plot or theme, identification with characters or incidents, and responding to imagery).

Karen Carroll (1979) believes that this taxonomy is similar to other well-known ones, and I think that it can also adequately describe comprehension on the verbal level.

Many of the research studies cited in this paper concentrated on assessing the relationship of linguistic factors to the lower levels of comprehension, especially the literal level.

Context Dependency

One benefit of dealing with this recall or recognition level is that the researcher can control his material to make sure it is context dependent. In other words, when testing comprehension the researcher must insure

he is only testing the processing of information contained in the sentence or passage provided and is not measuring some general intellectual ability to abstract or is not drawing on the listener's or reader's background or prior knowledge. For example, I recently examined the California Achievement Test, 1977 edition, Form and Level 19C. I was particularly interested in the reading comprehension sections. I found that by only reading the questions and not the passages upon which they are supposedly based, I was able to score well above the chance level on the interpretive and critical reading sections but only on the chance level on the recall sections. Therefore, I must conclude that the questinns allegedly testing the higher order comprehension skills are in fact testing something besides reading.

Factors Affecting Comprehension

Many factors, both non-linguistic and linguistic, affect comprehension. Among the non-linguistic are the following: the reader's or listener's motivation, his preferences, his intellectual and cultural background, the time he has to devote to the material, his age, his skill as a decoder, and the nature and maturity of the content. One important linguistic factor is the vocabulary used; are the words familiar or technical in nature; do they describe concrete, well-known things or abstract, abstruse ones; are the words short or long.

Another important linguistic factor is the style of the material; is it clear and concise or wordy and complex; is it similar to that of the decoder.

Two studies that are interesting and relevant to the above named linguistic factors were made by Ruddell (1965) and Edwards (1974). In the first of these, Ruddell discovered that the reading comprehension of his 4th grade subjects was significantly higher on passages using sentence patterns that they themselves used in conversation (having the same vocabulary, sentence length, and subject matter) than on passages using low frequency and usually more complex sentence types. In the second study, Edwards found that sentences containing idioms were more difficult for his 9th grade subjects to understand than those written in the more standard and more familiar literary English.

Two other studies that focused on one element that influenced comprehension, namely the conjunction, were done by Katz and Brent (1968) and Stoodt (1972). Since the latter is more inclusive and agrees with the findings of the former, I will only delineate its findings. Basically Stoodt used the cloze procedure to determine the relationship between conjunctions and reading comprehension of 4th grade children. She found that the easiest conjunctions for them were and, how, for, and as while the most difficult were when, so, but, or, where, while, that, and if. However, this study is not based on a larger theoretical framework nor is there even a suitable explanation as to why the words in one group are easier than those in the other.

PROCEDURES FOR MEASURING LINGUISTIC COMPLEXITY

Readability Formulas

A more popular and theoretically more encompassing way of assessing reading difficulty is by the use of some sort of readability formula. While these formulas usually concentrate on the syllabic structure of words, the length of sentences, and the frequency of lexical items, other factors have been included; among these are the ratio of dependent to independent clauses, the number of different words, the number of prepositional phrases, the number of pronouns, and the number of affixes to name a few. These formulas are validated by correlating passages ranked by them to the comprehension difficulty of subjects. Generally the data indicate that other things being equal, long words are more difficult to comprehend than short words; long sentences are more difficult to comprehend than short sentences, and rare words are more difficult to understand than frequently occurring ones.

However as is often the case in the real world, other things are rarely equal. These results may be confounded by other factors. For example, uncommon words may be difficult to understand because of the unfamiliarity or complexity of the concept to which they refer and not merely because of their scarcity per se. Sentences may be long and complex because of the nature of the content they deal with. On the other hand, a long word may be easier to decode since it often contains some known prefixes or suffixes which give clues to its meaning. Chomsky and others have shown that shorter sentences may be more complex and difficult

to understand than longer ones because of transformations, deletions and embeddings used in their construction.

If Ruddell is correct in his assertion that factors used in readability formulas can account for between 26 to 51 % of the variance in comprehension, there is indeed evidence that linguistic factors do influence comprehension to a considerable degree. However, these formulas have the limitation of concentrating on the surface structure of sentences. Chomsky's generative-transformational grammar, on the other hand, made researchers aware of the importance of the underlying deep structure of sentences.

T-Unit

One such attempt at measuring syntactic complexity beyond the surface structure of a sentence was proposed by Hunt (1969). Although his T-unit, or Terminable Unit, was originally designed to measure the syntactic complexity of maturing writers, it has been used to determine the readability of passages. Simply defined a T-unit is an independent clause and any subordinate clause(s), phrases(s), or word(s) modifying it. Such a unit divides compound sentences into individual units while treating complex sentences or sentences containing deletions and embeddings as a unit.

He found that as students increased in age, the number of words per T-unit also increased in their writing. In addition, embedding versus compounding or simply running sentences together increased with age and mental ability.

While the T-unit is a more sophisticated linguistic measure than readability formulas, it does have some theoretical limitations. For example, simply counting the number of words per T-unit is not a good index of syntactic complexity since the sentence

Aluminum is an abundant metal. (5 words/T-unit)

is linguistically more complex than

Aluminum is a metal which is abundant. (7 words/T-unit)

Chomsky would explain this by saying that the first is formed by using embedding plus deletion transformations while the second uses only an embedding transformation.

An elaboration of this study was made by Flahive and others (1980). This study attempted to determine the effectiveness of 4 objective measures of syntactic maturity and/or complexity in evaluating compositions written by undergraduate ESL students of various proficiency levels. The four measures used were:

1.) length of T-unit

2.) clause/T-unit ratio, that is the average number of clauses per T-unit. This is also referred to as the subordination ratio. Hunt found in his study that the subordination ratio increased with age.

3.) index of complexity-a complexity factor consisting of the number of words in the T-unit plus a weighted score for some transformations or complex morphological forms was divided by the number of words in the T-unit.

4.) errors/T-unit.

Their data revealed that as the proficiency level increased so did the length of the T-unit, the subordination ratio, and the complexity index. The errors per T-unit measure fluctuated over the various proficiency levels and showed no consistent trend. Further analysis indicated that the length of the T-unit and the subordination ratio had high discriminatory power. Pearson Product Moment correlations between these measures and holistic evaluations of the compositions revealed that for the lowest 3 proficiency levels, the highest correlations were between the subordination ratio and the evaluations while for the highest 3 proficiency levels, the highest correlations were between the length of the T-unit and the holistic evaluations.

The problem with these findings, like Hunt's discussed previously, is that the empirically determined most valid measures are weak on theoretical grounds. It appears that the T-unit does not adequately measure deep structure but in fact merely provides us with a surface look at the true deep structure.

Smith (1972-73) used the T-unit as defined by Hunt in studying reading comprehension, but his results were less than unequivocal. Smith constructed passages at four different syntactic levels, namely those characteristic of the 4th, 8th, and 12th grades and skilled adult. He used data derived from Hunt's study to construct these passages.

The vocabulary was consistent throughout, and the content was judged to be easy enough for fourth graders. Students from the fourth through the twelfth grade were given these passages; cloze procedure, using every 5th word deletion, was used to evaluate their reading performance.

Generally he found that students' comprehension was best on the passages written nearest their own production level. In fact regression analysis indicated that high school age students read 8th grade level material better than the supposedly less complex and easier 4th grade level material. Even the twelfth grade material was easier for them to read than the 4th grade material.

Smith's explanation is that these older, more sophisticated students found short, choppy sentences more difficult to understand. The problem, on the other hand, may be with the validity of the T-unit as a measure of linguistic complexity. Of course, another explanation is that linguistic complexity as measured by the T-unit is accurate but that in reality such complexity has little influence on comprehension.

Other Procedures

It goes without saying that there have been many other attempts to measure or assess the relationship of linguistic complexity to comprehension. Before going into these studies, it may be helpful to examine some of the techniques used.

Perhaps the most obvious method is to present the subjects with some linguistic material and then see how well they can recall it. While this procedure may seem simple enough, there are some problems with using it. It is possible for someone to parrot back what he has heard or read without having actually comprehended it. The researcher must also decide how to score the subject's responses; for example, will any incongruity between the stimulus sentence and the response sentence be scored as a mistake. If some leeway is allowed, recall may become paraphrase.

Some researchers using this recall technique provide clues or prompt words. Here is another variable which must be taken into account when trying to compare the results of one study with another. Blumenthal and Boakes (1967) found that deep structure subjects were more effective memory probes than deep structure objects, even when they held similar positions in the surface structure. For example, in the sentence

John is eager to please.

John is the subject, while in a seemingly similar sentence

John is easy to please.

John is in reality to object of please (It is easy to please John.) Thus John would be a more effective cue in the first sentence.

Blumenthal (1967) also found that deep structure subjects were better prompt words than adverbials in apparently the same position. For example, in the sentences

The letter was sent by John.
The letter was sent by mail.

John would be a better cue word.

Perfetti (1973) qualified the importance of the subject as a cue word. His findings were that subjects that function as actors and objects that function as recipients of action are better probes than subjects that are recipients of action and objects that are actors.

Danks and Sorce (1973) found that sentences containing high imagery words, in the sense of having concrete nouns, were recalled better or more frequently than sentences having low imagery words when such high and low imagery words were used as prompts.

Another use of recall is to have subjects presented with a sentence followed by a list of words and then have them recall the sentence verbatim and as many of the words as possible. The rationale for this is that the more complex the stimulus sentence, the more room it will take up in the short term memory and conversely the fewer the words that can be remembered.

Paraphrase is, of course, very similar to recall except leeway in recalling the stimulus sentence is permitted. The question again is in determining how much leeway is allowed. It is doubtful if studies can be validly compared if they differ in their scoring procedures and their use of cue words. There are also many other variables which must be taken into account when comparing the findings of

various studies.

Phoneme monitoring is another technique. Here the subjects listen to a sentance after having been instructed to listen for a word beginning with a specific sound and then to push a button as soon as they hear this sound. The rationale for using this as an indicator of linguistic complexity is that the longer the period between the introduction of the target sound and the pushing of the button, the more complex the linguistic structure being processed. The phoneme to be monitored, unknown to the subjects, appears immediately following the structure under investigation. For example, the subjects may have been instructed to listen for a word beginning with /m/ in the following sentences:

I saw the man had painted the house.
I saw that the man had painted the house.

Research has shown that /m/ in the second sentence is processed faster than its counterpart in the first sentence because that had given the subjects a clue to the correct deep structure while its absence in the first sentence necessitated that the subjects try to determine if man is the object of saw or the subject of had painted.

The problem with this technique is that this process seems divorced from what people actually do when listening to someone speak. Here, as in other techniques used, it is also possible that the differences may be statistically significant but to have no real pedagogical implications.

A somewhat similar task using visual stimuli is the process known as rapid serial visual presentation. Here the subjects are presented with words of a sentence in rapid succession and are then required to write down as many words as possible in the order in which they were presented. The number of words recalled correctly is taken as an index of processing difficulty; the more complex the sentence, the fewer the number of words that will be recalled.

This technique, as does testing by the use of a tachistoscope, suffers from the disadvantage of being significantly different from the usual reading process. It is also possible that what is being measured here is visual memory and not comprehension.

The cloze procedure is another popular research technique. Here every nth word is deleted and the subjects are required to fill them in correctly. The procedural problems with this technique are 1.) will synonyms or only exact replacements be scored as correct; 2.) what will be interval of deletions be (other things being equal, the larger the n, the more context clues provided); 3.) where will be first deletion be since that determines what words are left out. This last problem is usually solved by by combining the results from all possible combinations of the nth deletion.

The rationale for this procedure is that the more complex the sentences, the more difficult it will be to provide the words.

The problem, however, may be lexical in nature or lie in the content of the passage. An obvious advantage, on the other hand, is that this technique assesses comprehension using passages and not sentences in isolation as do many of the studies cited in this paper.

Some other methods used in the research studies were 1.) matching pictures to sentences, 2.) rearranging words and phrases printed on cards to form grammatical sentences, and 3.) answering multiple choice questions. The first two tasks were probably new to the students while the last might have been familiar if they had previously taken a standardized test. However, all of these seem remote from the usual comprehension processes undertaken in daily life.

Other factors that one must keep in mind when attempting to compare the results of studies are: the selection process, the age and intelligence of the subjects, their socioeconomic and ethnic backgrounds, their proficiency with English and even the number of subjects. Exactly why the particular subjects were chosen is rarely made clear: one gets the impression that they were handy. Many researchers seem to use undergraduate students taking introductory psychology courses at their institutions. There seems to be some question whether these students are representative of the population at large. Also what is easy for an adult is not necessarily easy for a child. Some studies use so few subjects that their

results may be unique, or at least severely limited.

Since the studies cited in this paper used many different types of students of various grade ranges, ages, and intelligence, and since they used different methods of assessing the relationship of linguistic complexity to comprehension, extreme caution must be used when attempting to compare the results of one study with another.

Measures Based On Generative-Transformational Grammar

The following studies were based on attempting to find a psychological basis for various tenets of Chomsky's generative-transformational grammar. The bais of this grammatical theory simply stated is that the kernel sentence, which is a simple, active, declarative, and affirmative sentence, is the easiest to produce and understand. Any variations of this basic sentence type, such as transforming an active to a passive, or making a statement into a question, or embedding an adjective or relative clause into a kernel, makes the resulting sentence more linguistically complex and hence it is reasoned more difficult to comprehend.

Turner and Rommetveit (1967) sought to determine if indeed actives were easier to process than passives and if nonreversible passives (John kicked the ball) were easier to process than reversible passives (John kicked the boy). Their subjects were nursery school to 3rd grade students, and the tasks performed were imitation, comprehension, and productions. For all grade levels and on all tasks, the

order of difficulty, from the easiest to the most difficult, of these structures was as follows:

1.) nonreversible active

2.) reversible active

3.) nonreversible passive

4.) reversible passive.

Slobin (1966) investigated how well students in kindergarten, 2nd, 4th,&6th grade and adults responded to the truth or falseness of stimulus sentences presented to them in 4 grammatical forms. Based upon their responses, he concluded that the order of linguistic complexity or difficulty was as follows, from the simplest to the most complex:

1.) kernels

2.) passives

3.) negatives

4.) negative passives.

He found, however, that the differences between the processing of the actives and passives could largely be eliminated by using nonreversible passives. Thus the difficulty here seems to be, at least in part, lexical in nature. It must also be remembered that these sentences were presented to the subjects in isolation.

Miller (1962) and Miller and McKean (1964) also investigated the relationship of kernels to passives and negatives by having their undergraduate subjects match various combinations of sentences. Their results are essentially

in accord with the previously cited studies. Basically they found that the more transformations separating a pair of sentences, the longer is took to match them.

Mehler (1963) discovered that when university students were asked to memorize a series of complex sentences of varying grammatical types, they tended to simplify the sentences. He believed that the sentences were processed into kernels and transformational tags, but that the transformational tags were forgotten more quickly than the kernel representations. Based upon the ease of recalling various sentences verbatim and the errors made, he listed the following forms in order of complexity, fromthe simplest to the most complex:

1.) kernels
2.) negatives
3.) passives
4.) negative questions
5.) negative passives
6.) negative passive questions
7.) questions
8.) passive questions.

While this ranking is generally in accord with the tenets of generative-transformational grammar, the ranking of questions as number 7 seems odd. However, one must remember that affirmative questions and negative questions (Are you going? versus Aren't you going?) mean essentially the same thing. Thus the role of semantics must be taken into account to explain this ranking.

Savin and Perchonock (1965) using the rationale of the previous study produced a hierarchy significantly different

from Mehler's. Like the above cited study they believed that the more complex a sentence, the more space the kernel and the various transformational tags occupied in the short term memory. Therefore, they reasoned, if subjects heard a sentence followed by a list of words, the number of words remembered would be inversely related to the complexity of the sentence. The subjects were undergraduates at the University of Pennsylvania. Based upon the results of their study, Savin and Perchonock listed the grammatical forms in order of difficulty, from the easiest to the most difficult:

1.) kernels
2.) wh-questions
3.) questions
4.) passives
5.) negatives
6.) negative questions
7.) emphatic sentences
8.) passive questions
9.) passive-negative questions
10.)emphatic passives
11.)negative passives.

Gough (1965) also tested the hypothesis that the hearer of a complex sentence must transform that sentence into its kernel before understanding it. He reasoned that the speed with which a sentence could be understood would vary according to the number and nature of transformations separating it from its underlying kernel. He presented his 21 undergraduate subjects with various sentence types immediately followed by a picture that either correctly depicted the action of the sentence or did not. They had to push a button indicating whether

the picture depicted the sentence or not. He found that active sentences were verified faster than passives and affirmatives faster than negatives.

However he also cautioned that the hypothesis that an affirmative differed from a negative simply by a syntactical transformation had to be rejected since when testing these, true statements, whether represented in the affirmative or the negative, were verified faster than false statements. In addition, affirmatives were heard more frequently than negatives in the real world.

Gough also pointed out that his results regarding the active and passive were confounded since passives were longer and heard less frequently than actives.

Another problem with passives was discovered by Franks and Bransford (1974). They presented to their 18 undergraduate subjects paragraphs containing short passives (SP), such as The floor was washed, in which no mention was made of the actor; short passives-semantic (SP-S), such as The floor was washed. Mr. Brown, the janitor who washed the floor, had worked here for 20 years, in which the actor was supplied in the immediately succeeding sentence; and full passives (FP), such as The floor was washed by the janitor, in which the actor was given. The subjects took a 9 question verbatim recall recognition test.

The subjects recalled the SP 74% of the time, the FP 48% of the time, and the SP-S only 39% of the time. Since the syntactic form of the SP and the SP-S was the same and if syntactic form alone affected sentence recall, these rates of

recall should have been the same. Since they were significantly different, another variable-namely semantic context- was said to be at work here.

Olson and Filby (1972) showed that active sentences were not invariably easier to process. If a subject was shown a picture which was coded in terms of the receiver of the action, then the passive sentence was easier to verify than the active. This, however, is not a common practice in either listening or reading situations. This is at best a linguistic insight relevant only to a very artificial situation.

Coleman (1964) took 2 long prose passages of almost 3,000 words each and simplified them by transforming nominalizations to active verbs (as in The boys' planning of the party was a lot of work to The boys planned the party, and it was a lot of work) and changing passives to actives. The simplified versions had almost the same number of morphemes and words as the originals. The 48 undergraduates had 12 minutes to read each of the versions and then took a multiple choice test. The results indicated that although there was no significant difference in the number of words read, more questions were answered correctly after reading the simplified versions.

Coleman and Miller (1968) again confirmed that the information gained from a passage, at least for 9 college sophomores, could be maximized by using concrete as opposed to abstract nouns, few nominalizations, many short words, and syntactically simple sentences.

Contradictory results were reported by Pearson (1974-75). His 8th grade subjects read a passage containing 2 syntactically complex sentences, containing one subordinate clause and one or more independent clauses; two compound sentences containing two independent clauses joined by the conjunction and; and three pair of simple sentences, one using so to explicitly join the sentences. The students were most accurate in recalling verbatim the complex sentences rather than the supposedly simpler sentences. This could result from the use of such subordinating words as since and because which help the reader logically get from one clause to another.

Bormuth and others (1970) made an attempt to determine empirically the comprehension difficulty of various syntactic structures. This complex study also investigated the comprehension difficulty of various pronoun constructions and intersentence structures by using a complex series of questions.

For the purposes of this paper, I am attaching Table I which lists the percentage of students responding correctly to questions testing various grammatical structures:

Table 1. Percentage of Students Responding Correctly to Questions Testing Each of the Sentence Structures.

Structure	% Correct
Comparative, unequal (Joe runs *faster than* Bill.)	88.3
Nominal compound, noun + verb + preposition + noun (*Hammer blow*, a blow struck with a hammer.	87.9
Nominalization, possessive + verb + ing (*His going* came as a surprise.)	87.0
Prenominal adjective (The *tall* boy is Joe.)	85.5
Subordinate sentence, causal (We came because we smelled lunch being served.)	83.3
Relative clause, with deletion (The man *working in the yard* is the owner.)	80.9
Nominalization, verb + ing (*Finding him* was easy.)	80.6
Adjectival prepositional phrase (The man *with the hat* manufactures cans.)	80.0
Subordinate sentence, after (*After we entered*, the play began.)	79.8
Nominalization, factive (The *fact that he came* surprised us.)	78.9
Subordinate sentence, although (*Although it rained recently*, the ground remains parched.)	77.3
Nominal compounds, verb + ing (*Washing machine*, The machine is for washing clothes.)	77.3
Subordinate sentence, purposive (*In order to make certain*, we asked a second time.)	76.3
Relative clause, appositive (Mr. Joseph, *who is our mailman*, retired.)	73.7
Nominal compound, someone operates (*Elevator operator*, Someone operates an elevator.)	71.7
Subordinate sentence, conditional (If we don't hurry, we'll miss the show.)	70.5
Nominal compound, noun + preposition + noun (*Ranger station*, a station for rangers)	69.8
Nominalization, for-to (*For us to find him* was difficult.)	69.6
Nominal compound, preposition + noun (*Potato dumpling*, The dumpling is made from potatoes.)	67.4
Relative clause, without deletion (The man *who has been working in the yard* is the owner.)	67.0
Adjective compliment (He is *clever* to go.)	66.2
Subordinate sentence, before (*Before we arrived*, people had already been seated.)	65.1
Subordinate sentence, tense shift if clause (*If you had some money*, you would buy some.)	61.4
Subordinate sentence, simultaneous (As *we entered*, the curtain rose.)	56.1
Comparative, equal (Joe runs *as fast as* Bill.)	28.1

Although these researchers presented their findings as a hierarchy of linguistic difficulty, this study has two major limitations:

1.) the study only involved 4th grade subjects

2.) the researchers felt that a large proportion of the subjects were not able to demonstrate a comprehension of even the basic structures. It is very possible that these students were not representative of the population at large. The investigators are vague about the locality from which they drew their subjects, only stating that the 240 fourth graders were from 3 semirural schools in the upper midwest. Because of this, the validity of the findings must be questioned.

Granowsky and Botel (1974) devised a syntactic complexity formula based on the tenets of generative-transformational grammar and research on children's processing of syntactic structures.

They caution that their scale is not a precise measure, that it should be used with some measure of vocabulary difficulty, and that it requires further validation. See Table II, Summary of Complexity Counts for their ranking:

TABLE II

SUMMARY OF COMPLEXITY COUNTS

0-COUNT STRUCTURES

Sentence Patterns - two or three lexical items

1. Subject-Verb-(Adverbial) He ran. He ran home.
2. Subject-Verb-Object (I hit the ball)
3. Subject-be-Complement (noun, adjective, adverb) He is good.
4. Subject-Verb-Infinitive (She wanted to play)

Single Transformations

1. interrogative (including tag-end questions) You did it, didn't you?
2. exclamatory (What a game!)
3. imperative (Go to the store.)

Coordinate Clauses joined by "and" (He came and he went.)

Non-Sentence Expressions (such as oh, well, yes)

1-COUNT STRUCTURES

Sentence Patterns - 4 lexical items

1. Subject-Verb-Indirect Object-Object (I gave her the ball.)
2. Subject-Verb-Object-Complement (We named her president.)

Noun Modifiers

1. adjectives (big, smart)
2. possessives (man's, Mary's)
3. quantitative determiners (all, many, one)
4. pre-determiners (some of, none of ... twenty of)
5. participles (in the natural adjective position: crying boy, scalded cat.
6. propositional phrase (The boy on the bench...)

Other Modifiers

1. adverbials (including prepositional phrases) when they do not immediately follow the verb in the SVAdv. pattern.
2. modals (should, would, must, ought to, dare to, etc.)
3. negatives (no, not, never, neither, not, n't)
4. set expressions (once upon a time, many years ago, etc.)
5. infinitives (when they do not immediately follow the verb in a SVInf. pattern.): I wanted her to play.
6. gerund (when used as a subject) Running is fun.

Coordinates

1. coordinate clause (joined by but, for, so, or, yet)
   I will do it or you will do it.
2. deletion in coordinate clauses (John and Mary, Swim or fish:
   a 1-count is given for each lexical addition)
3. paired coordinate both...and (Both Bob did it and Bill did it.)

2-COUNT STRUCTURES

Passive (I was hit by the ball, I was hit)

Paired conjunction (neither...nor, either...or) Either Bob will go or I will.

Dependent clauses (adjective, adverb, noun) I went before you did.

Comparatives (as...as, ...er than, same...as, more...than) He is bigger than you.

Participles (ed or ing forms not used in the usual adjective position)
Running, John fell. The cat, scalded, yowled.

Infinitives as subject (To sleep is important)

Appositives (when set off by commas) John, my friend, is here.

Conjunctive adverbs (however, thus, nevertheless, etc.) Thus, the day ended.

3-COUNT STRUCTURES

Clauses used as subjects (What he does is his concern.)

Absolutes (The performance over, Mr. Smith lit his pipe.

SPECIAL HANDLING

Noun clause of dialogue: separate speaker from what is said. Then count the parts as two sentences and add the counts.

Inverted order of adverbials of manner and place: add 1

Names and titles: regard as a simple noun in scoring.

Hyphenated Words - count as separate words.

Endicott (1973) also proposed a theoretical scale of syntactic complexity. Although its features are only sketched and his rationale for categorizing various linguistic features is not explained, his theory seems to be aimed at assessing the complexity of embedded units with a sentence. If this theory can be found to have validity, it will be an improvement on Hunt's T-unit. However at this point, nothing more can be said about it.

There have been studies of specific linguistic features, but by and large they offer little insight into the complexity-comprehension problem. For example, Fodor and Garrett (1967) found that their 20 MIT undergraduate subjects could paraphrase sentences better if the relative pronoun was present than when it was absent. However such a sentence as

The man (whom) the girl (that) my friend married knew died.

is rarely found in the real world and probably should be rewritten for clarity. It would be difficult to imagine coming across an entire paragraph written in this style.

Hakes and Cairns (1970) using some of the same sentences as Fodor and Garrett (1967) and similar undergraduate students as subjects got essentially the same results using phoneme monitoring instead of paraphrasing.

Hakes (1972) again using the phoneme monitoring task investigated the complementizer that. The 40 college freshmen that served as his subjects were aided in comprehending

such sentences as the following

Everyone who was at the party saw (that) Ann's date had made a complete fool of himself.

by the presence of that in the sentence. This word signals to the listener that a clause will follow it and that the next noun (Ann's date) will be the subject of that clause.

Others investigated the role of verb complexity as a factor in comprehension. Basically the research by Fodor and others (1968), Hakes (1971), and Holmes and Forster(1972) showed that verbs which can be followed by a clause, as in The man decided he would marry, are more difficult to process than simple verbs which can not be followed by a clause, as in The man emptied the bottle. This held true for Fodor's undergraduates who paraphrased sentences and solved anagrams, for Hakes' undergraduates who paraphrased and used phoneme monitoring, and for Holmes and Forster's paid volunteers from the University of Melbourne who had been speaking English for at least 10 years and were tested using rapid serial visual presentation.

While the research studies citied in this paper do show that linguistic factors influence comprehension, it was not possible to determine the extent to which these factors affect comprehension nor to validate a comprehensive hierarchy of linguistic difficulty generalizable over a wide age span.

A major problem of many of the research studies was that in attempting to control other non-linguistic variables influencing comprehension, artificial situations were set up yielding statistically significant, but contrived and possibly pedagogically meaningless, results. In addition, the research seemed to be primarily aimed at assessing comprehension at the literal or lowest level.

Some of the studies investigated the relationship of only one linguistic feature, such as the presence or absence of the relative pronoun, to comprehension and as a result had severely limited implications. Those that investigated the relationship of many features were not able to provide an unequivocal hierarchy of linguistic difficulty emperically validated over a wide age span or capable of being used in assessing the difficulty of material.

While this paper concentrated on morphological and syntactic factors affecting comprehension, no study of linguistic factors would be complete without a thorough look at semantic factors. Even then it must be remembered that comprehension is an interaction between the language or style of the material, the content of the material, and the reader or listener. Just examining the language alone will yield, at best, a limited, but insightful, view of the complicated process of comprehension.

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